Stamford Northern Development

Forecast Scenario Update Report

January 2018

V03

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1 Introduction

1.1 Background

Mouchel (more recently WSP Mouchel) have been commissioned to develop and update the Stamford Transport Model to help provide evidence in support of a land allocation known as the Land North of Stamford Development.

The allocation comprises two separate residential-led developments – one in South Kesteven for up to circa 1,350 dwellings (promoted by Burghley Estates), and one immediately to the west of this in Rutland, for up to circa 650 dwellings (promoted by Larkfleet Homes). In total, the Land North of Stamford development comprises 2000 residential dwellings and a number of other retail/commercial units.

The Land North of Stamford development is being assessed as part of the Local Plan Reviews of both South Kesteven District Council and Rutland County Council. The evidence provided will inform the decision to include this allocation in the forthcoming Local Plan(s). In addition this report and model will provide information to inform a Transport Assessment to support a possible future planning application for the Land North of Stamford development.

In addition to the development plans, a link road that provides access to the individual units of the development could be included as part of the coordinated approach and is included in the model forecasts. The link road would run from the B1081 Casterton Road from the west, through to Little Casterton Road, on to the A6121 Ryhall Road to the east. This road may provide additional benefits to Stamford.

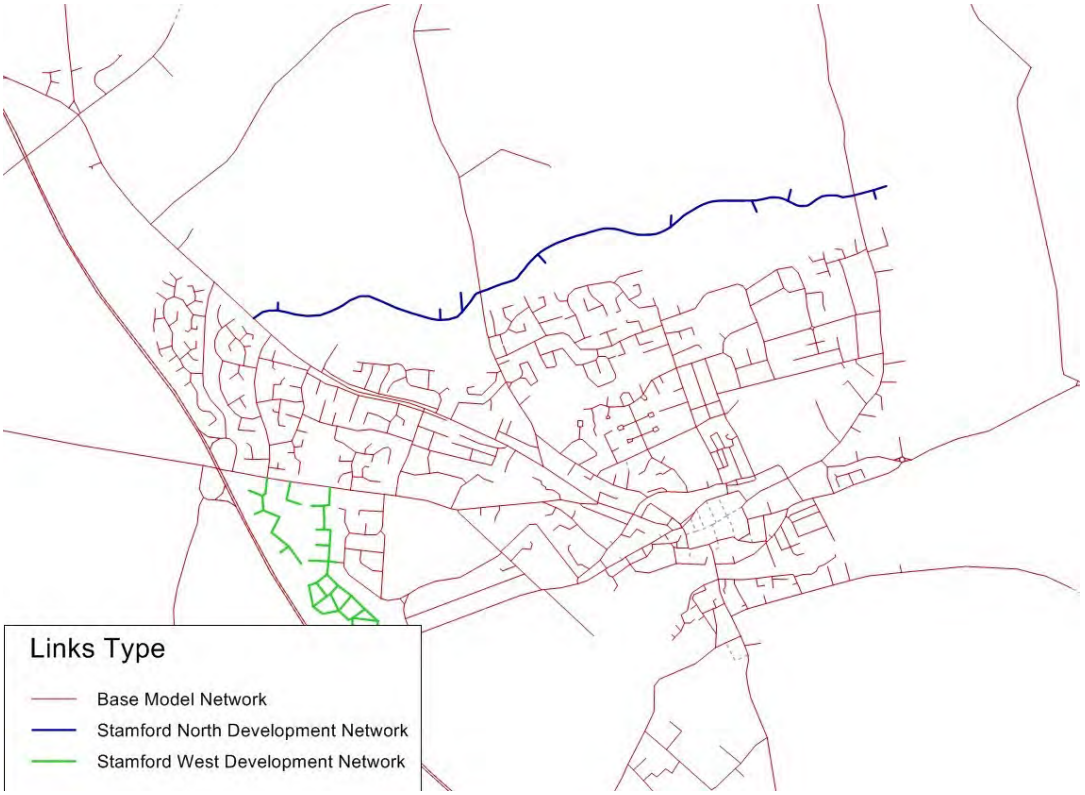
The model forecasts are being run by WSP, utilising forecast inputs agreed between Peter Brett Associates LLP and Lincolnshire County Council Highways Alliance, including the number of dwellings and retail unit surface area, and trip generation figures associated with each of the development units.

Two different networks have been coded to compare the Do Minimum (DM) and Do Something (DS) scenarios.

The Do Minimum network has been updated in order to contain the West Development proposed between Tinwell Rd and Empingham Rd. The Do Something scenario will consist of the Do Minimum updated network and those due to the Land of North Development mentioned above.

Figure 1-1 shows the Do Something networks. Green layout indicates DM improvements and blue indicates DS improvements.

Figure 1-1 Do Something Network



1.2 Purpose of this Technical Note

The purpose of this Technical Note is to update the Do Minimum and Do Something scenarios in order to incorporate the Stamford West Development in the Stamford VISUM model and to report an alternative Do Minimum methodology.

2 Traffic Assignment Results

2.1 Introduction

A detailed review of the model assignment results relating to the VISUM model runs was carried out to identify the impacts of the Link Road, the Stamford North Development and the Stamford West Development together.

Output results are provided with an explanation and a summary of the model outcomes used to compare the performance of the updated scenarios in the forecast years 2020, 2026 and 2036.

2.2 Stamford West Development

The consented application site is bound by A606 Empingham Rd to the north, existing residential areas to the east, A6121 Tinwell Rd to the south and the A1 to the west. The development proposes the construction of 400 houses and up to 14 hectares of employment, including a local centre. The development is expected to be completed in 2026.

Figure 2-1 below shows the location and proposed design for the West Development.

Figure 2-1 West Development proposed design

Source: Mixed Use Development Land at Stamford West Empingham Road Transport Assessment

The access/egress points to the proposed Stamford West Development will be located on:

- Empingham Rd with Arran Road. The intersection type proposed is a single lane roundabout that will provide access to the employment area of the Stamford West Development.
- A proposed junction on Empingham Road in front of The Malcolm Sargent Primary School. The proposed junction is a give-way intersection that connects the residential area of the Stamford West Development.
- A third give-way junction has been designed between the two mentioned above. This junction will connect Empingham Rd to the proposed extra care facility.
- The last junction will link Tinwell Rd to the southern residential area of the development. This junction has been designed as a give-way junction and a road will connect this access to the one located at The Malcolm Sargent Primary School.

In addition, neither the employment area nor the extra care facility are interconnected with the residential area by road.

The Stamford West Development Assessment report provided two different sets of generated trips by the development. Both sets were obtained using TRICS rates to forecast the number of trips that the future urban expansion will bring depending on the land use. The first of them provides average trips generated by the development while the second one gives the 85-percentile trips. In order to simplify the number of scenarios, it has been considered that the average trips provides a good gauge of the most likely generated trips by the construction of the Stamford West Development.

Table 2.1 below shows the average trips generated by this development as described in the report “Mixed Use Development Land at Stamford West Empingham Road Transport Assessment” with reference number “09-234-001.5” produced on March 2012.

Table 2-1 Predicted 2026 Stamford West Development Generated Trips

Stamford West Development	AM Peak		PM Peak	
	Arrivals	Departures	Arrivals	Departures
Residential	59	148	146	91
Employment	570	108	76	460
Total	629	256	222	551

2.3 Scenario Update

The future developments will absorb all the local growth and can only be accommodated based on TEMPRO projections for 2036, although in this case TEMPRO has not been used as a control on additional growth. Hence, it will be assumed that both developments will be full constructed by 2036.

In order to accommodate the future trips due to the future developments an alternative growth scenario is proposed. The assumed growth scenario consists of removing all employment and housing growth from TEMPRO leaving only “base” change in demand resultant from car ownership and trip rate changes over the model horizon. Thus, the forecast scenarios are as follows:

Table 2-2 –Stamford Development Scenarios

Scenario	Supply - network	Demand – matrices
Opening Year 2020		
Do Minimum (DM)	Base Year model network plus Stamford West Development Roads	Stamford West Development: - Residential area completed - No employment area yet. Demand Matrices: - Base cars controlled to TEMPRO alternative growth - LGVs/HGVs controlled to NTM forecasts
Do Something (DS)	As DM plus access road to Land North of Stamford development, and zone connectors to each of the eight zones for the development	As DM plus partial build-out of Land North of Stamford development trips: -110 residential dwellings - no retail units
Intermediate Year 2026		
Do Minimum (DM)	Base Year model network plus Stamford West Development Roads	Stamford West Development: - Completed Demand matrices: - Base cars controlled to TEMPRO alternative growth - LGVs/HGVs controlled to NTM forecasts
Do Something (DS)	As DM plus access road to Land North of Stamford development, and zone connectors to each of the eight zones for the development	As DM plus partial build-out of Land North of Stamford development trips: -770 residential dwellings - no retail units
Design Year 2036		
Do Minimum (DM)	Base Year model network plus Stamford West Development Roads	Stamford West Development: - Completed Demand matrices: - Base cars controlled to TEMPRO alternative growth - LGVs/HGVs controlled to NTM forecasts
Do Something (DS)	As DM plus access road to Land North of Stamford development, and zone connectors to each of the eight zones for the development	As DM plus full build-out of Land North of Stamford development trips: -2000 residential dwellings - all retail units (5450m2)

2.4 Convergence

Convergence is the measure used to determine model stability during the assignment process. A suitably converged model can be expected to produce consistent outputs with minimal model noise.

The convergence criteria recommended in TAG are given in Table 2-3 below.

Table 2-3 TAG Convergence Criteria

Measure of Convergence	Base Model Acceptable Values
Delta and % Gap	less than 0.1% or at least stable with convergence fully documented and all other criteria met
percentage of links with flow change (P) < 1%	four consecutive iterations greater than 98%
percentage of links with cost change (P2) < 1%	four consecutive iterations greater than 98%
Percentage change in total user costs (V)	Four consecutive iterations > 0.1%

The measure of convergence has been adapted to the parameters that can be obtained after running the ICA assignment as shown in Table 2-4 below.

Table 2-4 TAG Convergence Criteria for ICA assignment.

No.	Condition	Convergence Criteria
1	The final delays of the equilibrium assignment and those obtained from running ICA are closed, i.e. ICA produces delays that are consistent with the assignment result	More than 90% of turns have a relative difference in delay less than 5%
2	The turn volumes from the last equilibrium assignment are close to the smoothed volumes; and	More than 98% of turns have a GEH less than 1
3	The turn volumes from the last equilibrium assignment are close to those from the previous assignment.	More than 98% of turns have a GEH less than 1
4	The difference between the costs along the chosen routes and those along the minimum cost routes, summed across the whole network, and expressed as the percentage of the minimum costs	Less than 0.1% or at least stable with convergence fully documented and all other criteria met

Table 2-5 to Table 2-16 present convergence statistics from the three base year time periods including the iteration loop at which these criteria were all met over four consecutive iterations.

Table 2-5 Do Minimum 2020 Model Assignment Convergence Criteria 1 to 3

Criteria	Target	AM		PM	
		No. of Iterations	Achieved	Number of Iterations	Achieved
1	90%	1	93.09%	5	98.35%
		2	95.41%	6	98.82%
		3	96.83%	7	99.06%
		4	98.05%	8	99.19%
2	98%	1	100.00%	5	100.00%
		2	98.92%	6	100.00%
		3	99.91%	7	100.00%
		4	99.95%	8	100.00%
3	98%	1	98.66%	5	99.74%
		2	95.96%	6	99.83%
		3	99.71%	7	100.00%
		4	99.74%	8	99.61%

Table 2-6 Do Minimum 2020 Model Assignment Converge Criterion 4

Time Period	Iteration No.	Target	Target Achieved			
			Car	HGV	LGV	Overall
AM	1	<0.1% or at least stable	0.46%	0.11%	0.45%	0.43%
AM	2		0.16%	0.02%	0.08%	0.14%
AM	3		0.15%	0.02%	0.07%	0.13%
AM	4		0.14%	0.01%	0.05%	0.12%
PM	5		1.06%	0.01%	0.55%	0.95%
PM	6		0.90%	0.02%	0.49%	0.81%
PM	7		0.77%	0.01%	0.45%	0.70%
PM	8		0.82%	0.02%	0.53%	0.75%

Table 2-7 Do Minimum 2026 Model Assignment Convergence Criteria 1 to 3

Criteria	Target	AM		PM	
		No. of Iterations	Achieved	Number of Iterations	Achieved
1	90%	4	95.29%	9	96.24%
		5	96.52%	10	96.59%
		6	97.57%	11	97.91%
		7	98.65%	12	99.16%
2	98%	4	98.89%	9	98.73%
		5	99.93%	10	99.85%
		6	99.95%	11	99.86%
		7	99.98%	12	99.90%
3	98%	4	97.64%	9	99.52%
		5	99.93%	10	99.90%
		6	99.91%	11	99.93%
		7	99.98%	12	99.86%

Table 2-8 Do Minimum 2026 Model Assignment Converge Criterion 4

Time Period	Iteration No.	Target	Target Achieved			
			Car	HGV	LGV	Overall
AM	4	<0.1% or at least stable	0.21%	0.09%	0.11%	0.19%
AM	5		0.19%	0.04%	0.10%	0.16%
AM	6		0.15%	0.03%	0.08%	0.14%
AM	7		0.15%	0.02%	0.07%	0.13%
PM	9		0.22%	0.01%	0.19%	0.21%
PM	10		0.17%	0.01%	0.15%	0.16%
PM	11		0.21%	0.01%	0.13%	0.19%
PM	12		0.30%	0.01%	0.14%	0.26%

Table 2-9 Do Minimum 2036 Model Assignment Convergence Criteria 1 to 3

Criteria	Target	AM		PM	
		No. of Iterations	Achieved	Number of Iterations	Achieved
1	90%	1	92.08%	5	96.12%
		2	96.30%	6	96.84%
		3	97.26%	7	97.92%
		4	98.10%	8	98.17%
2	98%	1	100.00%	5	98.90%
		2	99.90%	6	99.55%
		3	100.00%	7	99.88%
		4	99.98%	8	100.00%
3	98%	1	96.92%	5	97.51%

		2	97.65%	6	99.91%
		3	99.62%	7	99.90%
		4	99.62%	8	99.73%

Table 2-10 Do Minimum 2036 Model Assignment Converge Criterion 4

Time Period	Iteration No.	Target	Target Achieved			
			Car	HGV	LGV	Overall
AM	1	<0.1% or at least stable	0.81%	1.44%	0.62%	0.84%
AM	2		0.71%	1.23%	0.62%	0.75%
AM	3		0.65%	0.99%	0.64%	0.68%
AM	4		0.57%	0.77%	0.55%	0.59%
PM	5		0.67%	0.05%	0.61%	0.63%
PM	6		0.51%	0.03%	0.53%	0.49%
PM	7		0.61%	0.02%	0.53%	0.57%
PM	8		0.72%	0.02%	0.49%	0.65%

Table 2-11 Do Something 2020 Model Assignment Convergence Criteria 1 to 3

Criteria	Target	AM		PM	
		No. of Iterations	Achieved	Number of Iterations	Achieved
1	90%	3	95.19%	2	98.21%
		4	96.28%	3	98.74%
		5	97.86%	4	98.95%
		6	98.54%	5	99.01%
2	98%	3	98.86%	2	99.88%
		4	99.90%	3	99.91%
		5	99.97%	4	100.00%
		6	99.98%	5	99.98%
3	98%	3	96.34%	2	99.22%
		4	99.61%	3	99.69%
		5	99.95%	4	99.69%
		6	99.81%	5	99.90%

Table 2-12 Do Something 2020 Model Assignment Converge Criterion 4

Time Period	Iteration No.	Target	Target Achieved			
			Car	HGV	LGV	Overall
AM	3	<0.1% or at least stable	0.16%	0.00%	0.06%	0.14%
AM	4		0.13%	0.01%	0.04%	0.11%
AM	5		0.13%	0.00%	0.04%	0.11%
AM	6		0.12%	0.00%	0.03%	0.10%
PM	2		1.30%	0.01%	0.69%	1.18%
PM	3		1.09%	0.01%	0.57%	0.99%
PM	4		0.95%	0.01%	0.50%	0.86%
PM	5		0.81%	0.01%	0.47%	0.74%

Table 2-13 Do Something 2026 Model Assignment Convergence Criteria 1 to 3

Criteria	Target	AM		PM	
		No. of Iterations	Achieved	Number of Iterations	Achieved
1	90%	-	-	10	95.80%
		1	92.28%	11	96.36%
		2	97.52%	12	97.18%
		3	98.30%	13	98.57%
2	98%	-	-	10	99.08%

		1	100.00%	11	99.81%
		2	99.98%	12	99.95%
		3	100.00%	13	99.97%
3	98%	-	-	10	98.95%
		1	98.10%	11	99.35%
		2	99.20%	12	99.73%
		3	99.93%	13	99.85%

Table 2-14 Do Something 2026 Model Assignment Converge Criterion 4

Time Period	Iteration No.	Target	Target Achieved			
			Car	HGV	LGV	Overall
AM	-	<0.1% or at least stable	-	-	-	-
AM	1		0.64%	0.27%	0.44%	0.59%
AM	2		0.53%	0.11%	0.40%	0.48%
AM	3		0.48%	0.08%	0.37%	0.43%
PM	10		0.27%	0.01%	0.26%	0.26%
PM	11		0.19%	0.01%	0.19%	0.18%
PM	12		0.15%	0.01%	0.16%	0.15%
PM	13		0.28%	0.01%	0.16%	0.26%

Table 2-15 Do Something 2036 Model Assignment Convergence Criteria 1 to 3

Criteria	Target	AM		PM	
		No. of Iterations	Achieved	Number of Iterations	Achieved
1	90%	5	97.60%	1	93.84%
		6	95.39%	2	96.84%
		7	96.84%	3	97.92%
		8	98.15%	4	98.37%
2	98%	5	99.95%	1	100.00%
		6	99.66%	2	99.91%
		7	99.95%	3	99.98%
		8	99.97%	4	100.00%
3	98%	5	99.52%	1	97.65%
		6	97.76%	2	98.66%
		7	99.90%	3	99.56%
		8	99.97%	4	99.83%

Table 2-16 Do Something 2036 Model Assignment Converge Criterion 4

Time Period	Iteration No.	Target	Target Achieved			
			Car	HGV	LGV	Overall
AM	5	<0.1% or at least stable	0.37%	0.23%	0.39%	0.36%
AM	6		0.18%	0.12%	0.17%	0.17%
AM	7		0.17%	0.12%	0.16%	0.16%
AM	8		0.15%	0.11%	0.14%	0.14%
PM	1		1.56%	0.15%	1.29%	1.45%
PM	2		1.01%	0.04%	0.89%	0.94%
PM	3		0.77%	0.06%	0.69%	0.72%
PM	4		0.71%	0.03%	0.63%	0.66%

All the modelled peaks meet the criteria 1 to 3 set on WebTAG. On the other hand, the criterion 4 has to be checked between two consecutive runs, which means, the difference of the percentages should be smaller than 0.1%. In addition, when the 0.1% is not achieved between two consecutive runs, the results have to be stable, for instance, demonstrating a decreasing trend between iterations.

Both conditions have been meet in most of the scenarios, achieving the convergence within a relatively small number of iterations. Therefore, the model is fit for the purpose of reproducing the route choices as well as forecasting the impacts of the future developments in Stamford.

Further evaluation may be required in case of using the model and its outputs for economic appraisal purposes which typically demand much closer tolerances than those suitable for operational analysis.

2.5 Network Summary Statistics

The following summary highway network tabular and graphical information is provided:

1. Total number of assigned trips;
2. Total network travelled distance as vehicle kilometres;
3. Total network travelled time as vehicle hours; and
4. Average network speeds.

Modelled flows, queues and delays in the study area are obtained in order to compare the DM and the DS 2036.

Plots of the flow, queue and delay difference between the scenarios are also provided to further indicate the impact of the scheme. Tables and plots of forecast flows for key parts of the highway network within the study area are also appended.

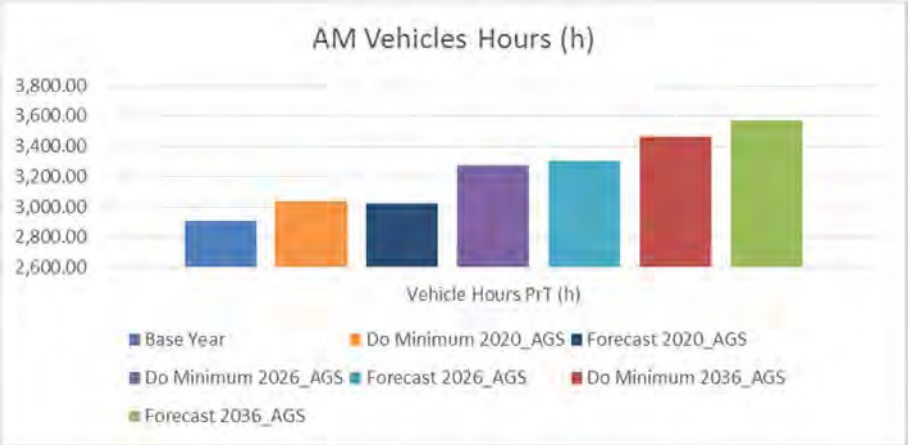
The Figure 2-2 below shows the chosen detailed study area:

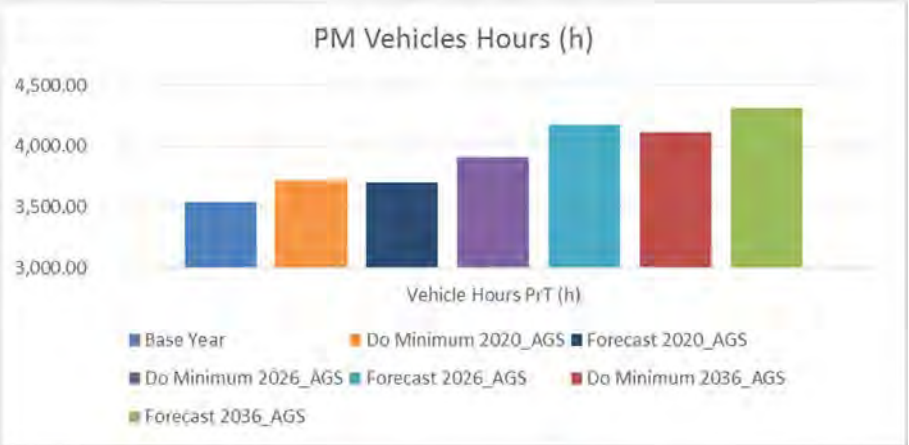
Figure 2-2 Network Study Area

2.6 Network Summary Statistics

Distance, journey time and total delays are reported in Figure 2-3 to Figure 2.5. Speeds are shown in Figure 2-6. All figures are included in Table 2-17.

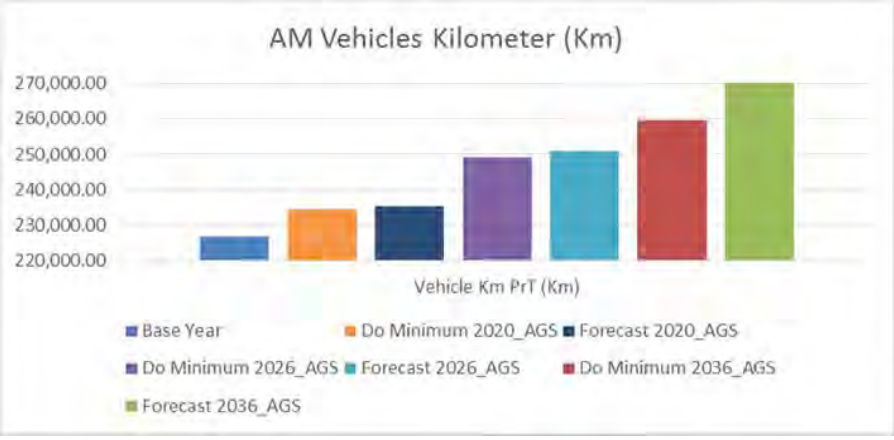
Figure 2-3 Network Vehicle Hours.

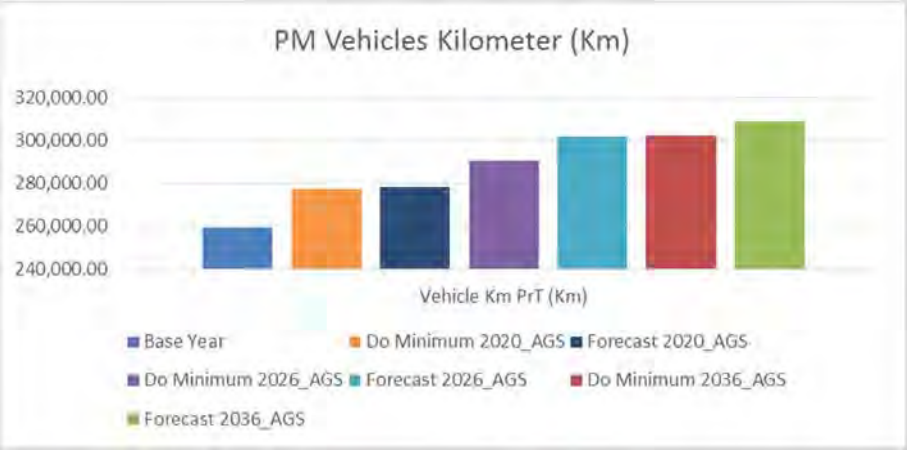




The results show an increasing of the journey time proportional to the increasing of the demand between the analysed scenarios.

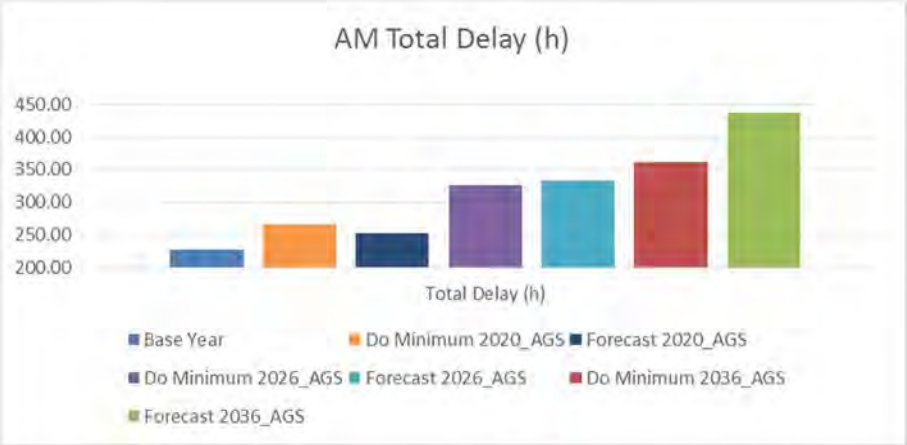
Figure 2-4 Network Vehicle Kilometres.

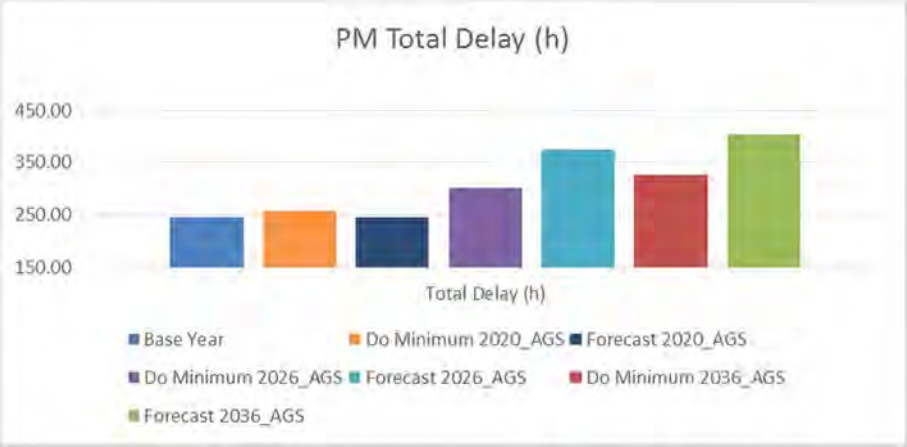




The results show an increasing trend of the travelled distance related to the growth of the demand between the forecast years.

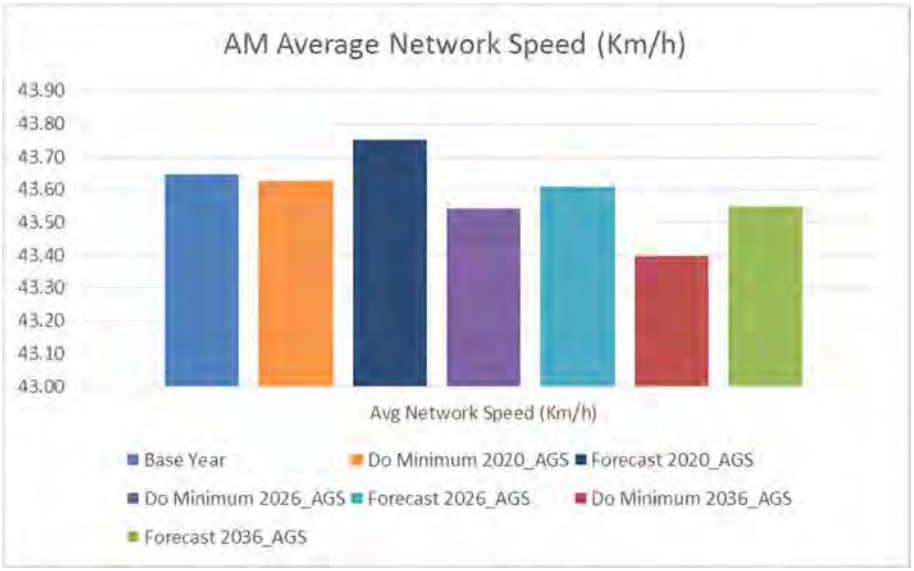
Figure 2-5 Network Total Delay.

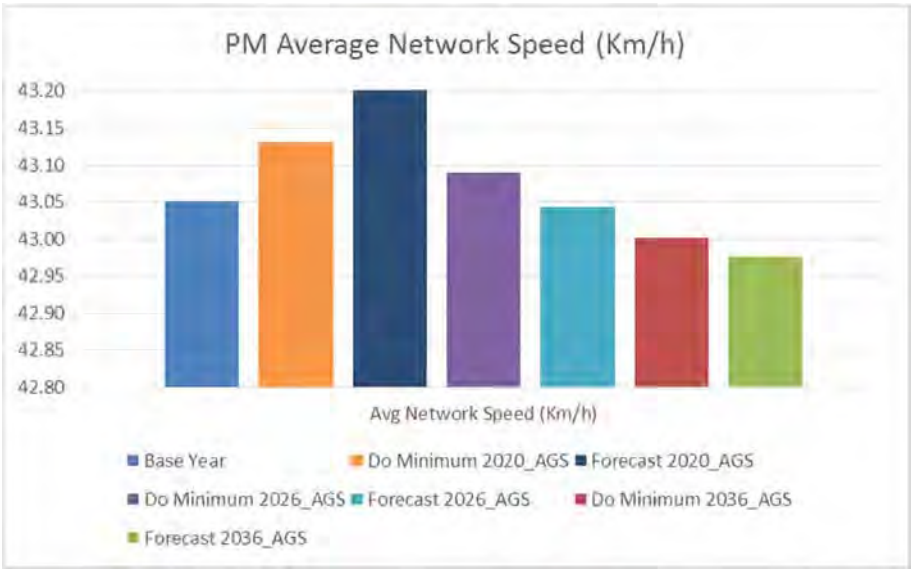




The rise in the delays, year on year, is caused by both the increase in demand and the configuration of proposed junctions to access to the Land of North Development. Reduced delay in the earlier forecast year is attributed to background traffic use of the infrastructure developed for the Stamford North Development

Figure 2-6 Network Average Speed (Km/h)





The average speed comparison between the scenarios shows that the impact of the future development on the speeds is trivial. As above the highest speeds are indicated in 2020 as the additional (full) Stamford North network outweighs the relatively limited additional traffic demand. There was no information available on infrastructure phasing to support a variation to the additional network in this early year.

Table 2-17 Results Summary

Scenario	Peak	Avg Network Speed (Km/h)	Vehicle Hours PrT (h)	Vehicle Km PrT (Km)	Total Delay (h)	Demand Car	Demand HGV	Demand LGV
Base Year	AM	43.6	2,907	226,738	227	10,329	311	1,290
DM 2020	AM	43.6	3,039	234,492	266	10,744	322	1,445
DS 2020	AM	43.7	3,020	235,185	252	10,798	322	1,445
DM 2026	AM	43.5	3,273	249,186	327	11,528	334	1,675
DS 2026	AM	43.6	3,301	250,932	333	11,891	334	1,675
DM 2036	AM	43.4	3,462	259,565	362	11,624	360	2,019
DS 2036	AM	43.5	3,573	271,175	438	12,828	360	2,019
Base Year	PM	43.1	3,539	259,133	245	11,887	147	1,034
DM 2020	PM	43.1	3,719	277,176	258	12,346	152	1,159
DS 2020	PM	43.3	3,703	278,034	245	12,399	152	1,159
DM 2026	PM	43.1	3,905	290,396	301	13,031	159	1,343
DS 2026	PM	43.0	4,177	301,708	375	14,471	159	1,343
DM 2036	PM	43.0	4,109	302,061	327	13,128	171	1,619
DS 2036	PM	43.0	4,311	308,819	405	14,471	171	1,619

A detailed list of link outputs for the area of study can be found in Appendix A.

The following Figures show the flow difference between the DS and DM scenario.

Figure 2-7 2020 AM Flow Differences. DS – DM

Figure 2-8 2020 AM Flow Differences. DS – Base

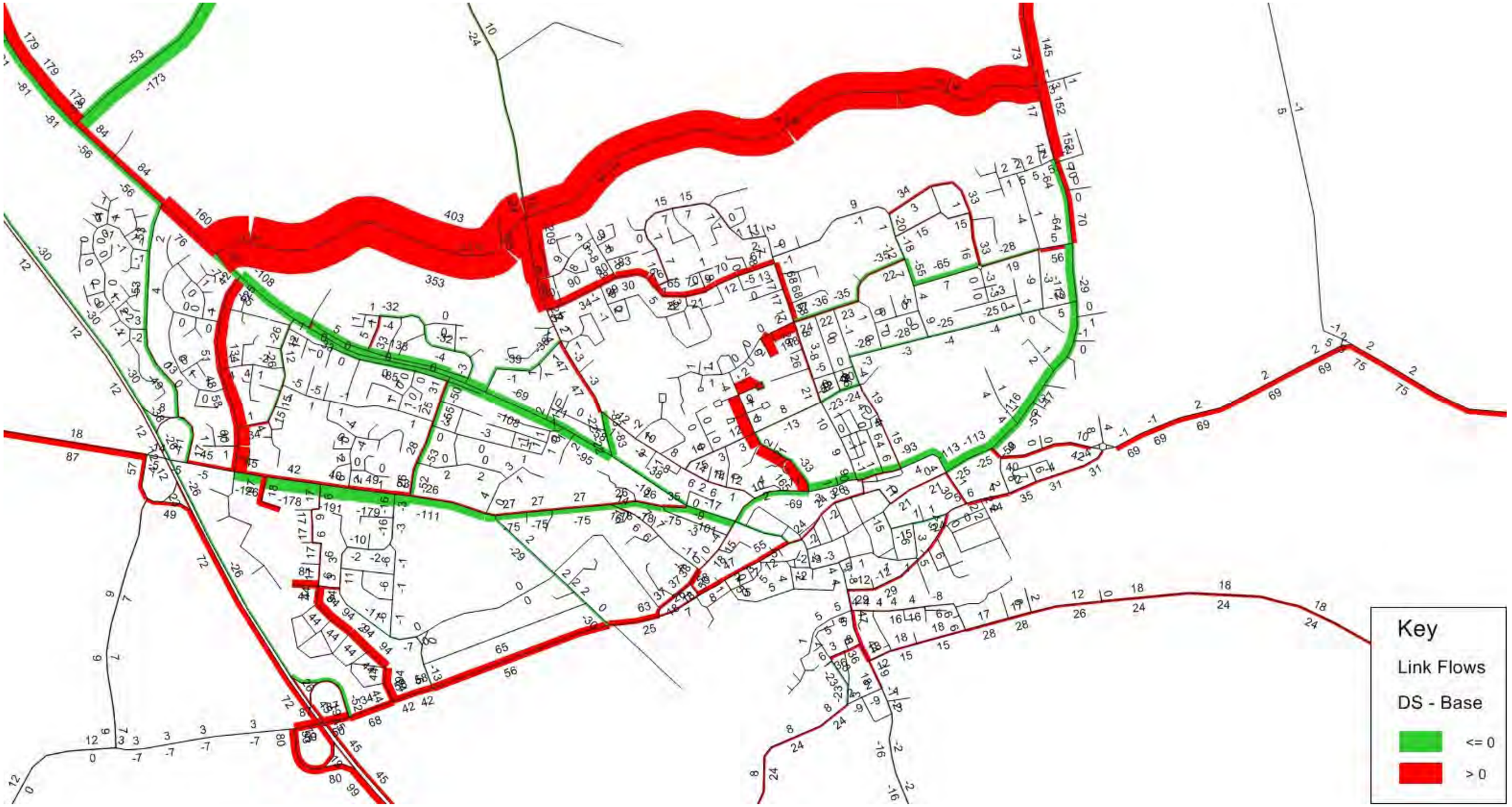


Figure 2-9 2020 PM Flow Differences. DS - DM

Figure 2-10 2020 PM Flow Differences. DS - Base

Figure 2-11 2026 AM Flow Differences. DS – DM

Figure 2-12 2026 AM Flow Differences. DS – Base

Figure 2-13 2026 PM Flow Differences. DS - DM

Figure 2-14 2026 PM Flow Differences. DS - Base

Figure 2-15 2036 AM Flow Differences. DS – DM

Figure 2-16 2036 AM Flow Differences. DS – Base

Figure 2-17 2036 PM Flow Differences. DS - DM

Figure 2-18 2036 PM Flow Differences. DS - Base

The comparison between the Do Something scenario with the Do Minimum and Base Year scenarios show reasonable changes in flows on the network.

The reduction of the traffic within the town centre between the DS and DM is due to a change in the routing decision of the drivers. In order to avoid the most congested areas, the drivers use the proposed link road of the future development.

On the other hand, the comparison between the DS scenario and the Base Year shows the expected increase of traffic through the future development, the town centre as well as through the A1. This is due to the combined increase in traffic flows by both Stamford West and Stamford North developments. However, this increase also occurs between the Base Year and Do Minimum scenarios.

Further flow plots containing closer detail can be found in Appendix B.

The delays have also dropped down in the town centre of Stamford as consequence of the development's road when the DM scenario is compared to the DS. However, the DS also shows an increase of the delays along the proposed link road and near roads. This is reasonable since more traffic is using these roads to avoid the congestion in the town centre.

The following Figures (2-19 onwards) show the average delay difference between the DS and DM scenario.

Figure 2-19 2020 AM Town Centre Average Delay Differences (s). DS – DM

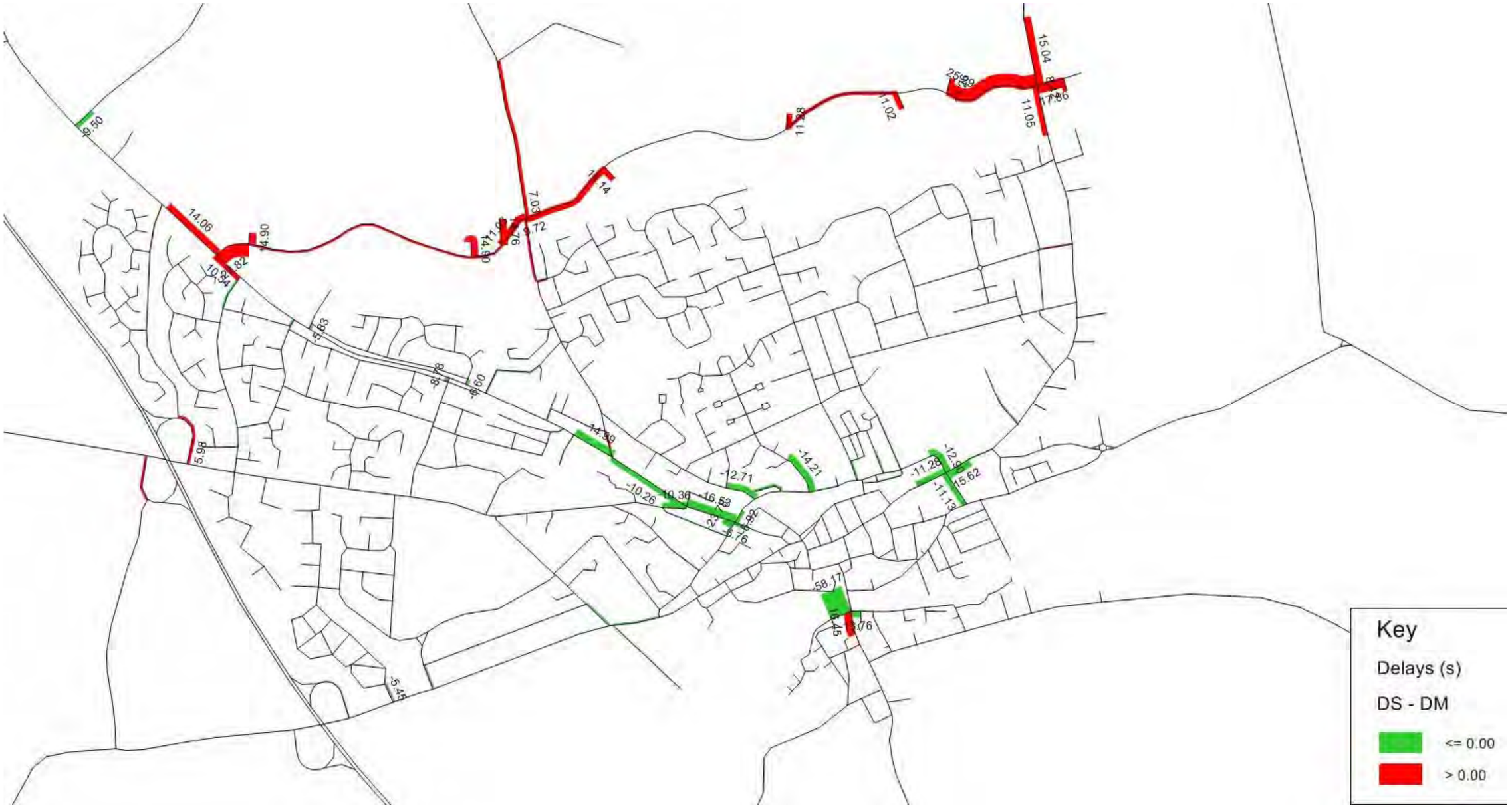


Figure 2-20 2020 PM Town Centre Average Delay Differences (s). DS – DM

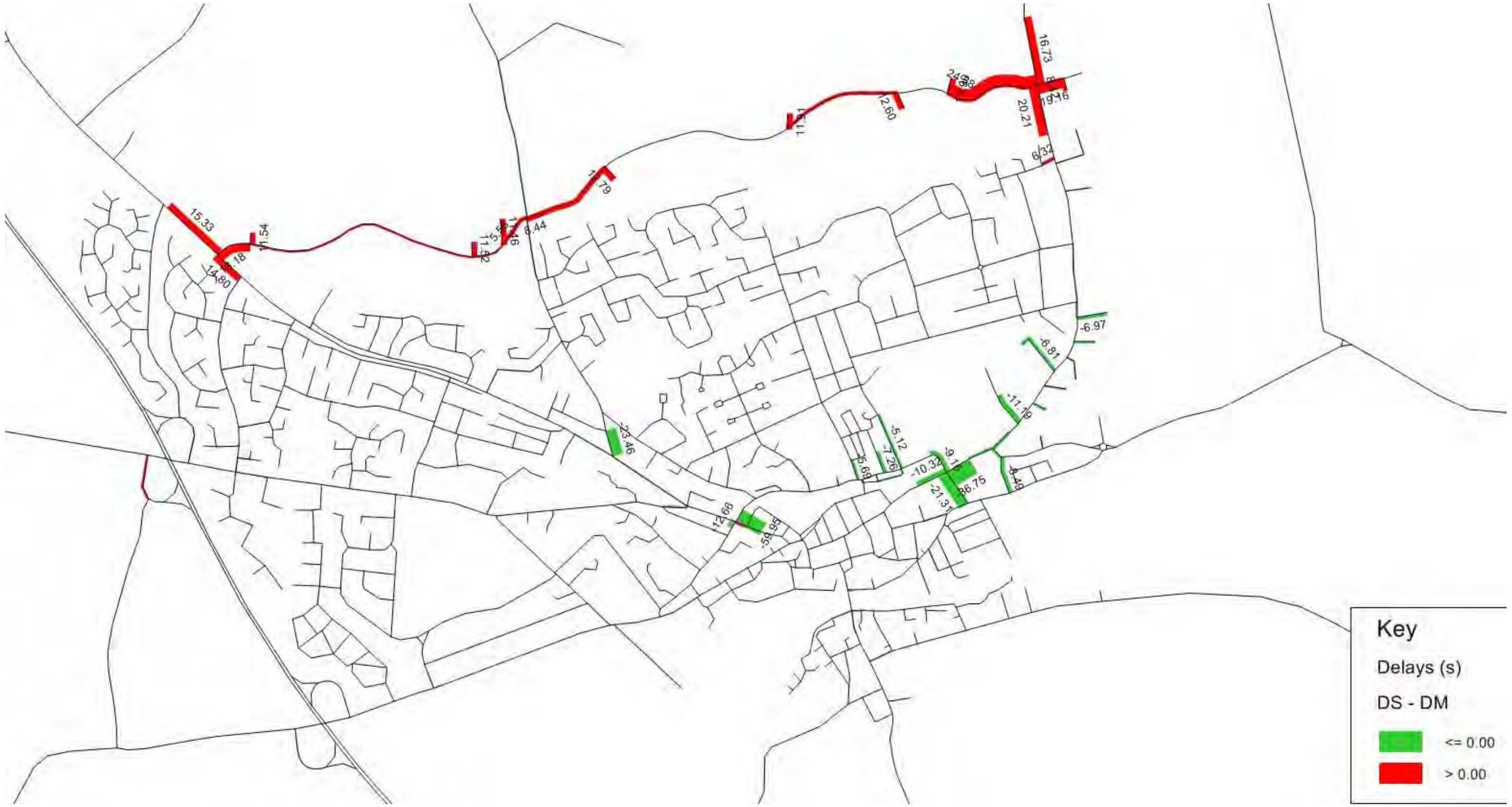


Figure 2-21 2026 AM Town Centre Average Delay Differences (s). DS – DM

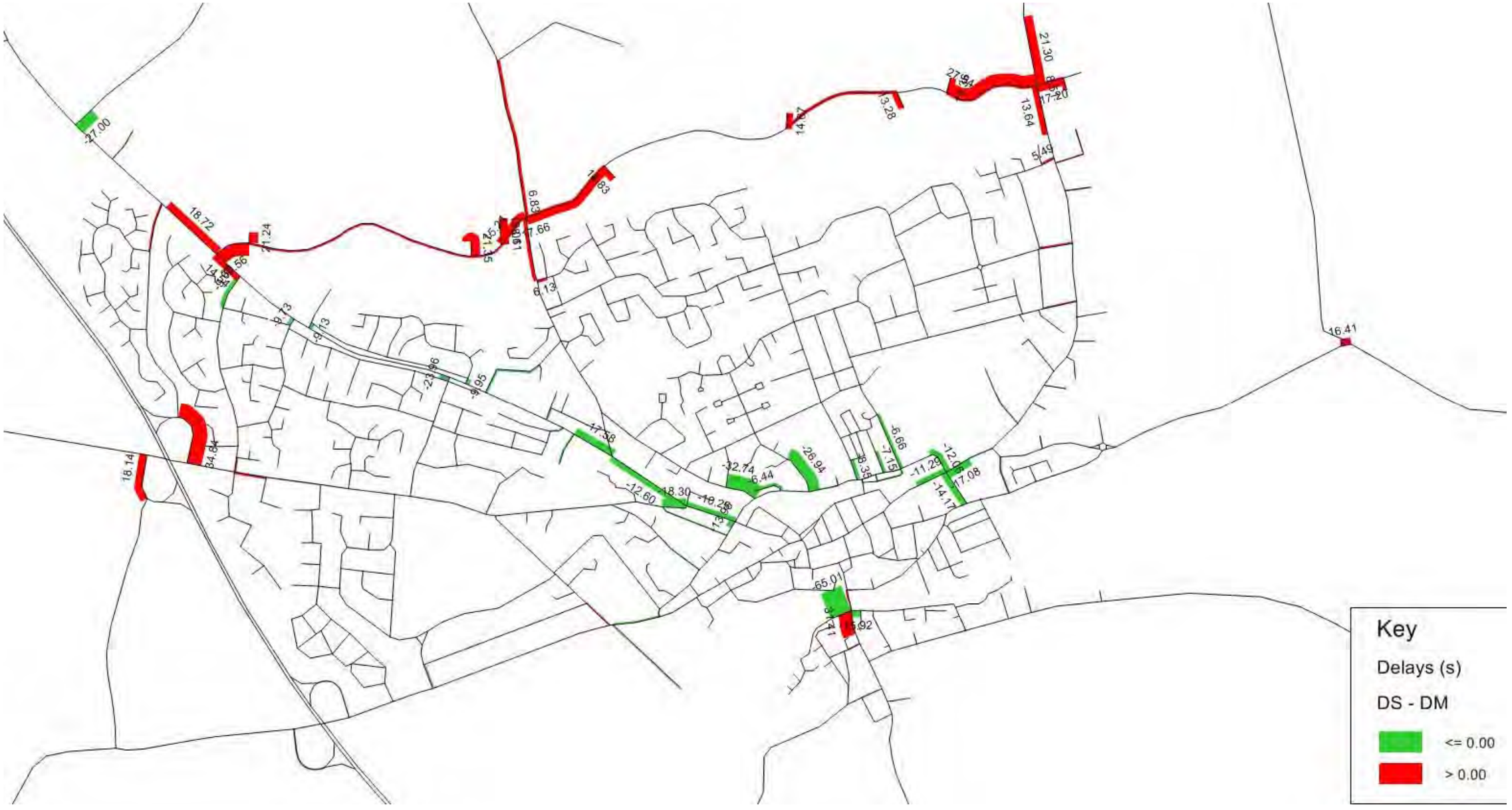


Figure 2-22 2026 PM Town Centre Average Delay Differences (s). DS – DM

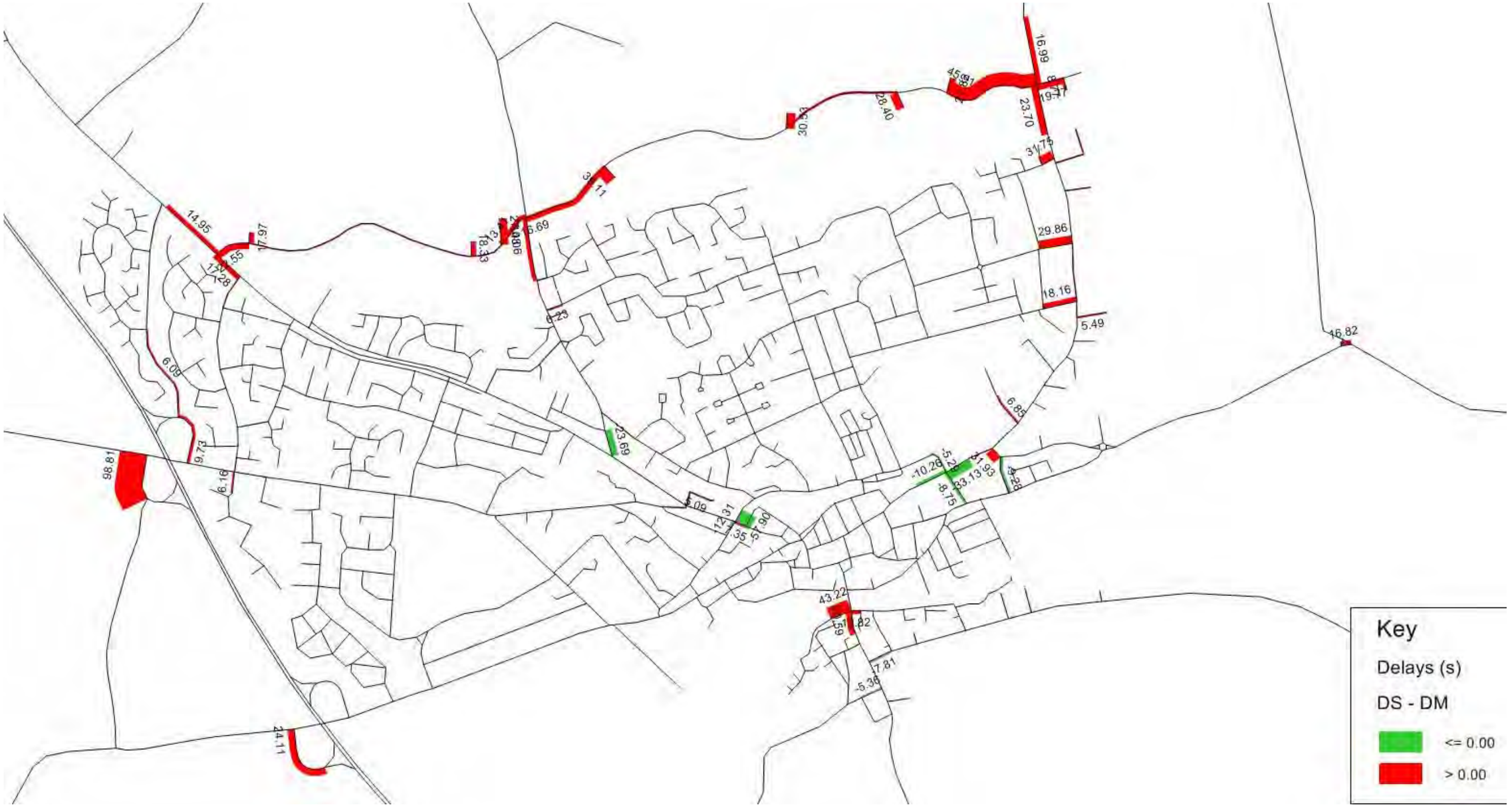


Figure 2-23 2036 AM Town Centre Average Delay Differences (s). DS – DM

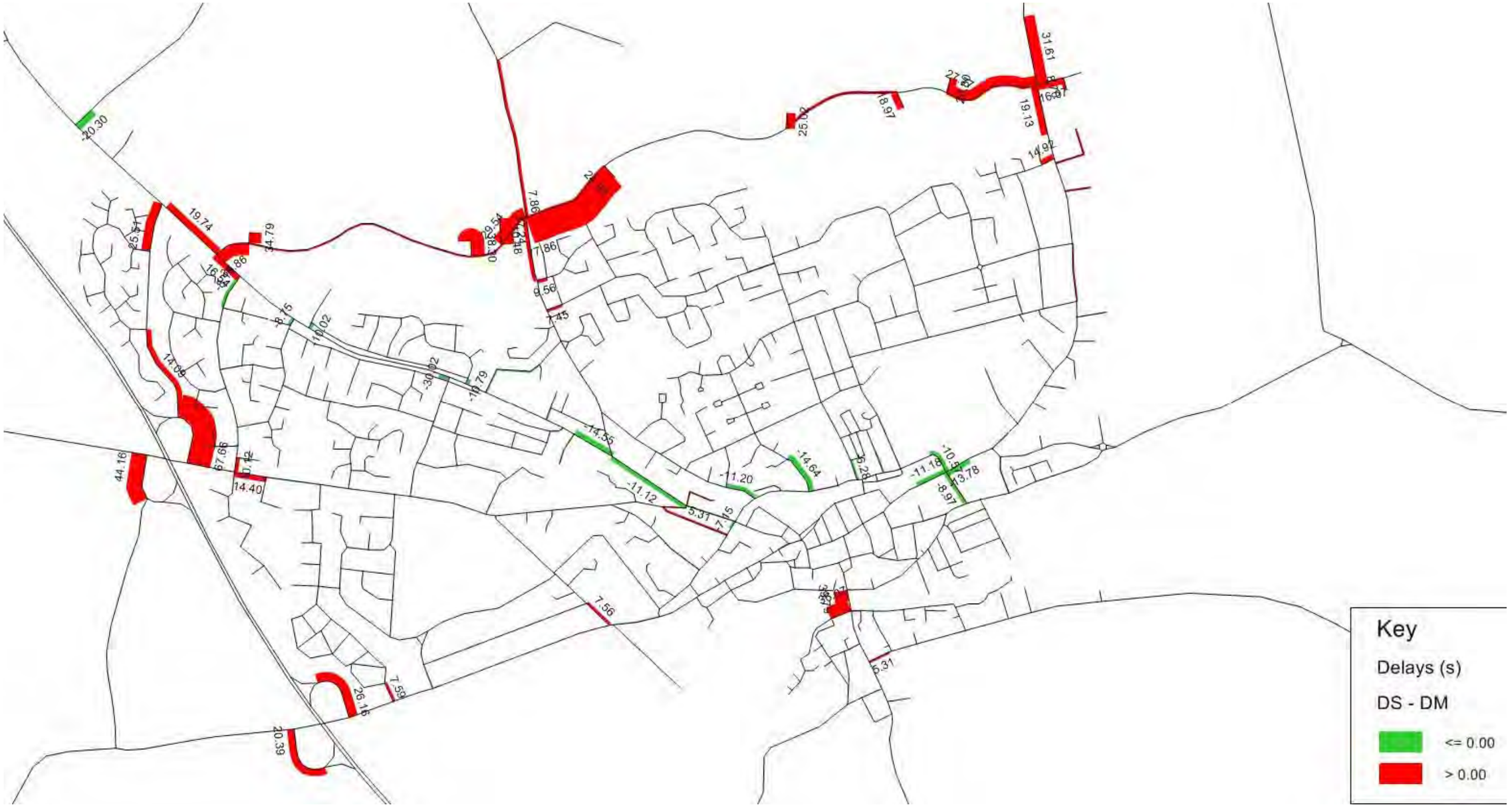
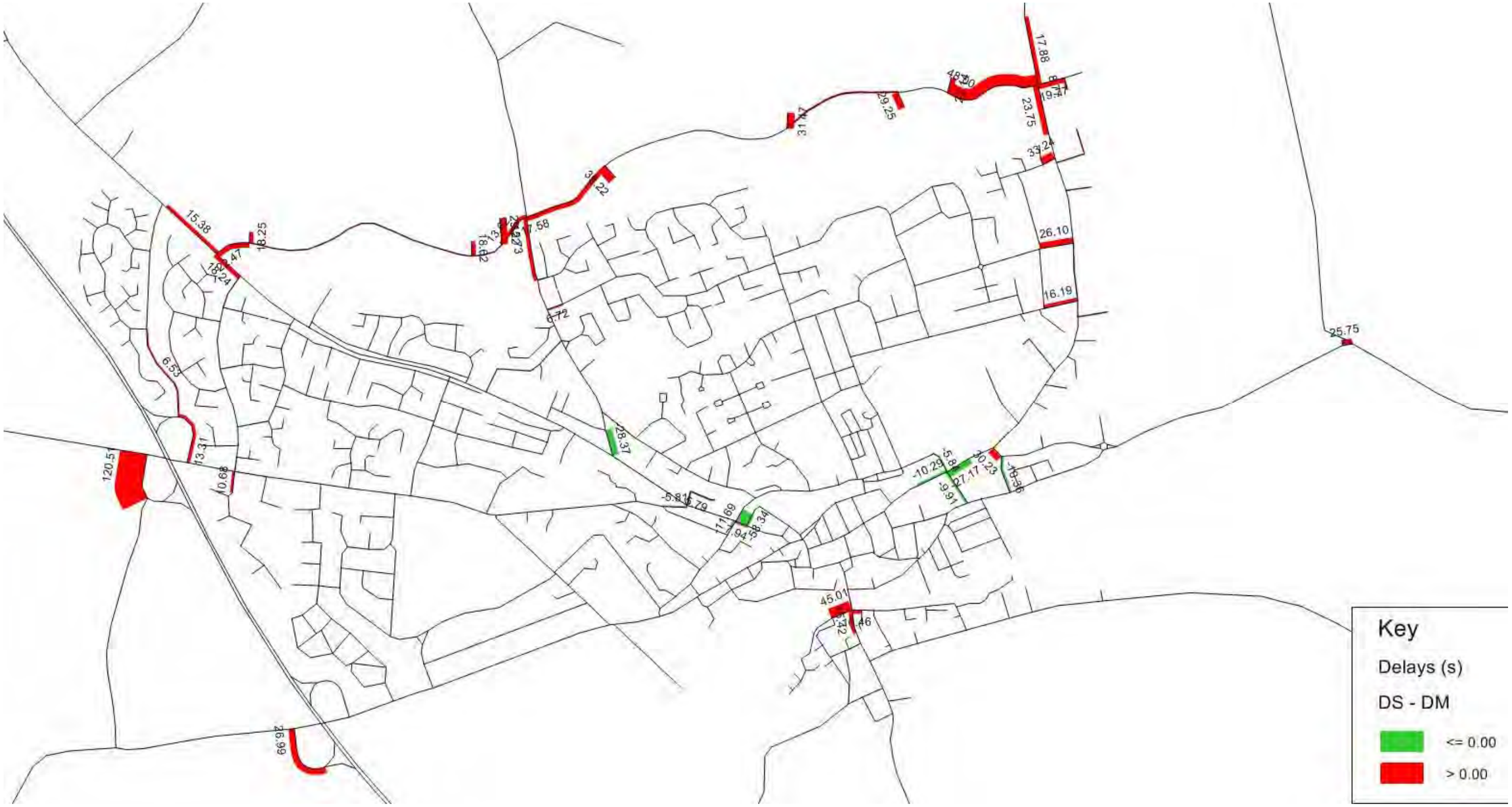


Figure 2-24 2036 PM Town Centre Average Delay Differences (s). DS – DM



Further delay plots can be found in Appendix C.

Similarly to the delays, the maximum queues have been reduced within the town centre as consequence of the link road.

Figure 2-25 2020 AM Town Centre Max Queue Differences (m). DS – DM

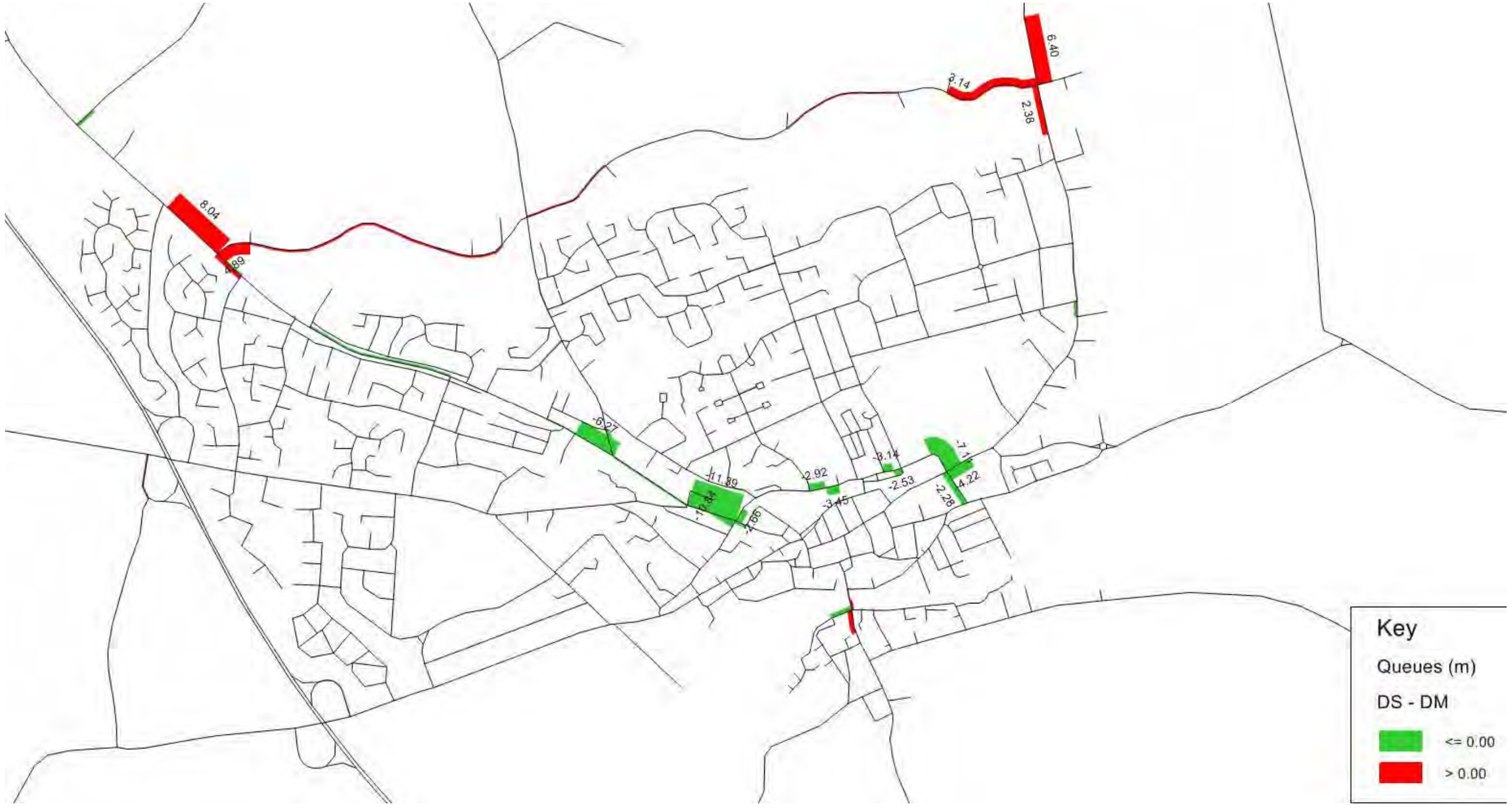


Figure 2-26 2020 PM Town Centre Max Queue Differences (m). DS – DM

Figure 2-27 2026 AM Town Centre Max Queue Differences (m). DS – DM

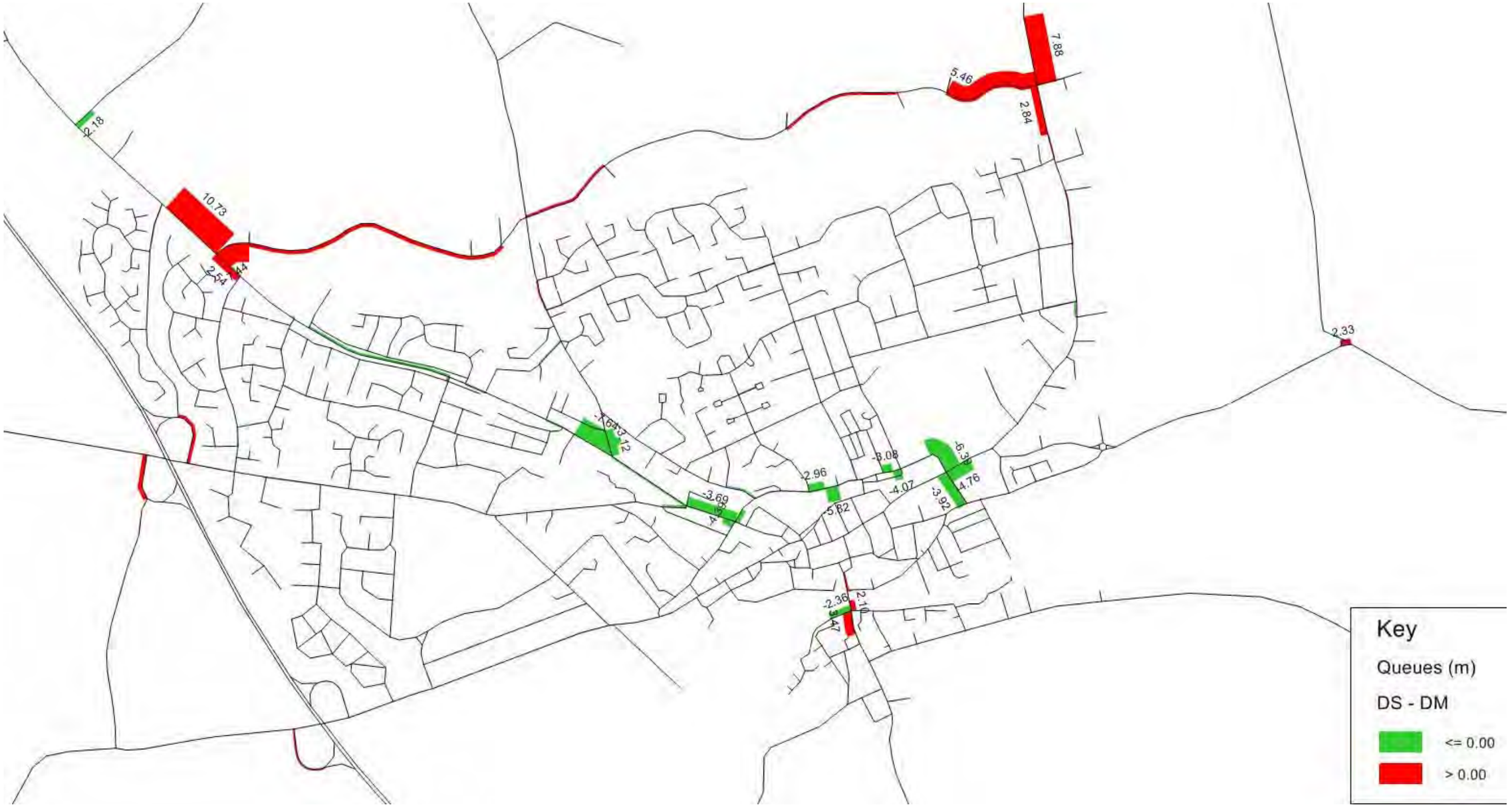


Figure 2-28 2026 PM Town Centre Max Queue Differences (m). DS – DM

Figure 2-29 2036 AM Town Centre Max Queue Differences (m). DS – DM

Figure 2-30 2036 PM Town Centre Max Queue Differences (m). DS – DM

Further queue plots can be found in Appendix D.

3 Conclusion

3.1 Summary

This technical note has described the comparison between the Do Minimum and Do Something by forecast year as well as the Base year model. The DM scenario consists of the full establishment of the West Development by 2036 while the DS also includes the complete development on the Land North of Stamford.

The model outputs have been analysed and compared in order to assess the impact of the full development of the Land North of Stamford by 2036. The main outputs gathered from the VISUM model are:

- Flows
- Queues
- Delays
- Journey Distance
- Journey Time

3.2 Conclusion

The future development will bring additional traffic to the northern area of Stamford. In addition, the route choice is clearly affected by the congestion in the town centre and the geometry constraints of the junctions. Nevertheless, the link road will carry most of this traffic and it will also help to relieve the congestion in the town centre.

In conclusion, the full development by 2036 would impact on the existing road conditions when compared to the DM. The most important drawbacks shown by the Do Something when compared to the Do Minimum is the increase of the queues and delays at the junctions with the Stamford local roads. However, these are limited to the nearest areas of the Northern Lands and therefore the impact on the town centre traffic movements is minor.

Detailed junction assessment should be conducted to derive a more detailed picture of the traffic impacts of the proposed development.

Appendix A

Model Link Outputs

Appendix B

Modelled Flow Plots

Appendix C

Modelled Delay Plots

Appendix D

Modelled Queue Plots

Appendix E

Modelled V/C Plots

Appendix F

HE Scenario Results